

APPENDIX H

RANGE CARDS AND SECTOR SKETCHES

The success of a defense depends on the positioning of soldiers and weapons. To position their weapons effectively, platoon leaders must know the characteristics, capabilities, and limitations of their weapons, the effects of terrain, and the enemy. However, the platoon leader is not done after merely positioning his weapons. He must ensure that each weapon can effectively engage the enemy, and the sum of his weapons can effectively mass coordinated direct fires on the enemy. The platoon leader accomplishes this by making his soldiers produce detailed range cards, by making his squad leaders and section leaders produce detailed, coordinated sector sketches, and by personally inspecting individual soldier positions, reviewing subordinate sector sketches and coordinating with adjacent units to develop a detailed and accurate platoon sector sketch.

Section I. RANGE CARDS

A range card is a sketch of the assigned sector a direct fire weapon system is intended to cover. A range card aids in planning and controlling fires and aids the crews and squad gunners in acquiring targets during limited visibility. It is also an aid for replacement personnel or platoons or squads to move into the position and orient on their sector. The individual soldier or gunner should make the range card so that he becomes more familiar with the terrain in his sector. He should continually assess the sector and, if necessary, update his range card. To prepare a range card, the gunner must know the following information:.

- Sectors of fire.
- Target reference points.
- Dead space.
- Maximum engagement line.
- Weapons reference point.

H-1. SECTORS OF FIRE

A sector of fire is a piece of the battlefield for which a gunner is responsible. He may be assigned a primary and a secondary sector. Leaders use sectors of fire to ensure fires are distributed across the platoon's area of responsibility.

a. A sector of fire is assigned to cover possible enemy avenues of approach. Leaders should overlap sectors to provide the best use of overlapping fire and to cover areas that cannot be engaged by a single weapon system.

b. The leader assigns left and right sector limits using prominent terrain features or easily recognizable objects such as large rocks, telephone poles, fences, or stakes.

H-2. REFERENCE POINTS/TARGET REFERENCE POINTS

Leaders designate natural or man-made features as reference points. A soldier uses these reference points for target acquisition and range determination. Some reference points may also be designated as target reference points. A target reference point (TRP) is an easily recognizable point on the ground (natural or manmade) used to initiate, distribute, and control fires. The company or battalion designates TRPs, and platoon and squad leaders should also designate TRPs. TRPs should always be visible. These may also be useful as indirect-fire targets.

a. The commander or platoon leader designates TRPs used as indirect fire targets so that target numbers can be assigned.

b. TRPs should be visible through all spectrums available to the unit. They must be easily identifiable to the defender during daylight. TRPs must be heated so they can be recognized with thermal sights, and they must have an infrared signature so they can be recognized through night vision devices.

H-3. DEAD SPACE

Dead space is any area that cannot be observed or covered by direct-fire systems within the sector of fire. All dead space within the sector must be identified to allow the platoon leaders, BCs and squad leaders to plan indirect fires (mortars, artillery, or M203) to cover the area. The BFV crew, working with their wingman vehicle crew, must walk the engagement area so gunners can detect dead spaces through the ISU (or IBAS). The squad leader must do the same to identify dead space for his M249s, and the M240B when employed.

H-4. MAXIMUM ENGAGEMENT LINE

The maximum engagement line (MEL) is the depth of the sector is normally limited to the maximum effective engagement range of the weapons systems. However, it can be less if there are objects that

prevent the soldier from engaging targets at maximum effective ranges of his assigned weapon. To assist in determining the distance to each MEL, the soldier should use a map to ensure that the MELs are accurately depicted on the range card. Identifying the MEL will decrease ammunition expenditure necessary during an engagement.

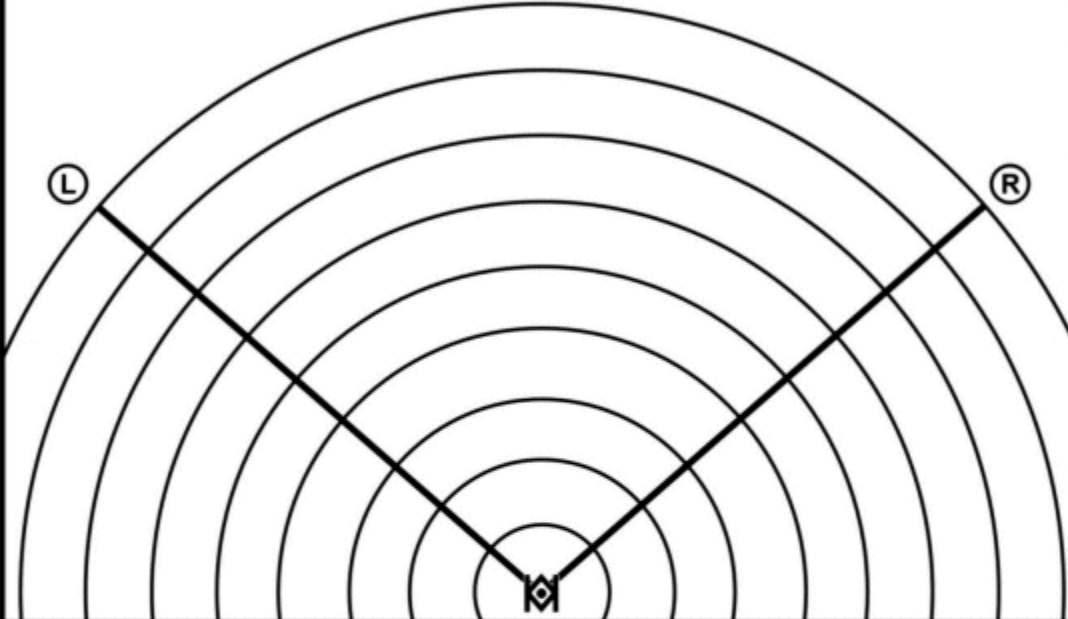
H-5. WEAPONS REFERENCE POINT

The weapons reference point (WRP) is an easily recognizable terrain feature on the map used to assist leaders in plotting the vehicle, squad, or weapon position. The WRP is used to assist leaders in plotting positions, and assisting replacement personnel in finding positions.

H-6. PREPARATION PROCEDURES

The individual soldier or gunner prepares two copies of the range card. If alternate and supplementary firing positions are assigned, two copies are required for these as well. A copy is kept with the vehicle, and the other given to the section leader for his sketch.

- a. Draw the weapon symbol in the center of the small circle. Draw two lines from the position of the BFV extending left and right to show the limits of the sector ([Figure H-1](#)).

STANDARD RANGE CARD <small>For use of this form see FM 7-8. The proponent agency is TRADOC.</small>					
SQD ____ PLT ____ CO ____	May be used for all types of direct fire weapons.				MAGNETIC NORTH
					
DATA SECTION					
POSITION IDENTIFICATION				DATE	
WEAPON			EACH CIRCLE EQUALS _____ METERS		
NO.	DIRECTION DEFLECTION	ELEVATION	RANGE	AMMO	DESCRIPTION
REMARKS					

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Figure H-1. Placement of weapon symbol & left & right limits.

b. Determine the value of each circle by finding a terrain feature farthest from the position and within the weapon system's capability. Determine the distance to the terrain feature. Round off the distance to the next even hundredth, if

necessary. Determine the maximum number of circles that will divide evenly into the distance. The result is the value of each circle. Draw the terrain feature on the appropriate circle on the range card. Clearly mark the increment for each circle across the area where DATA SECTION is written. For example, in ([Figure H-2](#)) a hilltop at 3,145 meters is used. The distance is rounded to 3,200 meters, divided by 8, and equals 400. Thus, each circle has a value of 400 meters.

STANDARD RANGE CARD <small>For use of this form see FM 7-8. The proponent agency is TRADOC.</small>					
SQD ____ PLT ____ CO ____	May be used for all types of direct fire weapons.				MAGNETIC NORTH
POSITION IDENTIFICATION			DATE		
WEAPON			EACH CIRCLE EQUALS <u>400</u> METERS		
NO.	DIRECTION DEFLECTION	ELEVATION	RANGE	AMMO	DESCRIPTION
REMARKS					

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Figure H-2. Circle value.

(1) [Figure H-3](#) shows a farmhouse at 2,000 meters on the left limit. The wood line at 2,600 meters annotates the right limit. Determine the distance to these features by using a map or a hand-held laser range finder. Note how the

circle markings can assist in positioning the features on the range card.

STANDARD RANGE CARD <small>For use of this form see FM 7-8. The proponent agency is TRADOC.</small>					
SQD ____ PLT ____ CO ____	May be used for all types of direct fire weapons.				MAGNETIC NORTH
POSITION IDENTIFICATION			DATE		
WEAPON			EACH CIRCLE EQUALS <u>400</u> METERS		
NO.	DIRECTION DEFLECTION	ELEVATION	RANGE	AMMO	DESCRIPTION
REMARKS					

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Figure H-3. Terrain features for left and right limits.

(2) Draw all reference points and target reference points in the sector. Mark each with a circled number beginning

with 1. [Figure H-4](#) shows the hilltop as reference point (RP) 1, a road junction as RP 2, and road junction RP 3. There are times when a TRP and a reference point are the same point (for example, RP 2 and RP 3 above). The TRP is marked with the first designated number in the upper right quadrant, and the reference point marked in the lower left quadrant of the cross. This occurs when a TRP is used for target acquisition and range determination. Road junctions are drawn by determining the range to the junction, by drawing the junction, and by drawing the connecting roads from the road junction.

STANDARD RANGE CARD For use of this form see FM 7-8. The proponent agency is TRADOC.					
SQD _____ PLT _____ CO _____	May be used for all types of direct fire weapons.				MAGNETIC NORTH
POSITION IDENTIFICATION			DATE		
WEAPON			EACH CIRCLE EQUALS <u>400</u> METERS		
NO.	DIRECTION DEFLECTION	ELEVATION	RANGE	AMMO	DESCRIPTION
REMARKS					

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Figure H-4. Reference points/target reference points.

(3) Dead space ([Figure H-5](#)) is shown as an irregular circle with diagonal lines drawn inside. Any object that prohibits observation or coverage with direct fire will have the circle and diagonal lines extend out to the farthest

maximum engagement line. If the area beyond the dead space can be engaged, the circle is closed.

STANDARD RANGE CARD <small>For use of this form see FM 7-8. The proponent agency is TRADOC.</small>					
SQD ____ PLT ____ CO ____	May be used for all types of direct fire weapons.				MAGNETIC NORTH
POSITION IDENTIFICATION			DATE		
WEAPON			EACH CIRCLE EQUALS <u>400</u> METERS		
NO.	DIRECTION DEFLECTION	ELEVATION	RANGE	AMMO	DESCRIPTION
REMARKS					

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Figure H-5. Dead space.

(4) Maximum engagement lines (MELs) are shown as in [Figure H-6](#). They are drawn at the maximum effective engagement

range per weapon if there is no dead space to limit their range capabilities. Note how the MEL for HE extends beyond the dead space in [Figure H-6](#). This indicates a higher elevation where HE area suppression is possible. MELs are not drawn through dead space. The maximum effective ranges for Bradley weapon systems are:

STANDARD RANGE CARD <small>For use of this form see FM 7-8. The proponent agency is TRADOC.</small>					
SQD ____ PLT ____ CO ____	May be used for all types of direct fire weapons.			MAGNETIC NORTH	
POSITION IDENTIFICATION			DATE		
WEAPON			EACH CIRCLE EQUALS <u>400</u> METERS		
NO.	DIRECTION DEFLECTION	ELEVATION	RANGE	AMMO	DESCRIPTION
REMARKS					

Figure H-6. Maximum engagement lines.

(5) The WRP ([Figure H-7](#)) is represented as a line with a series of arrows extending from a known terrain feature and pointing in the direction of the Bradley symbol. This feature is numbered last. The WRP location is given a six-digit grid. When there is no terrain feature to be designated as the WRP, the vehicle's location is shown as an eight-digit grid coordinate in the remarks block of the range card. (In [Figure H-7](#) the WRP is number 4.)

NOTE: When the WRP cannot be drawn precisely on the sketch, because of to the vehicle location, it is drawn to the left or right nearest the actual direction.

STANDARD RANGE CARD <small>For use of this form see FM 7-8. The proponent agency is TRADOC.</small>					
SQD <u>A22</u> PLT <u>2</u> CO <u>C</u>	May be used for all types of direct fire weapons.				MAGNETIC NORTH
POSITION IDENTIFICATION			DATE		
WEAPON			EACH CIRCLE EQUALS <u>400</u> METERS		
NO.	DIRECTION DEFLECTION	ELEVATION	RANGE	AMMO	DESCRIPTION
REMARKS					

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Figure H-7. Weapon reference point.

c. Complete the data section ([Figure H-8](#)).

STANDARD RANGE CARD <small>For use of this form see FM 7-8. The proponent agency is TRADOC.</small>					
SQD <u>A22</u> PLT <u>2</u> CO <u>C</u>	May be used for all types of direct fire weapons.				 MAGNETIC NORTH
POSITION IDENTIFICATION <u>PRIMARY A22</u>			DATE <u>3 MAR</u> / <u>1140 HRS</u>		
WEAPON <u>M2 C-21</u>			EACH CIRCLE EQUALS <u>400</u> METERS		
NO.	DIRECTION DEFLECTION	ELEVATION	RANGE	AMMO	DESCRIPTION
L	350° / 5800 μ	Ø μ	2000M	TOW2	FARMHOUSE
R	105° / 920 μ	+ 10 μ	2600M	TOW2	R/SLIDE WOODLINE
1	6400 μ	+ 30 μ	3200M	TOW2	RP-HILLTOP
2	5910 μ	+ 10 μ	2700M	TOW2	TRP-AB00Z RJ
3	60 μ	- 10 μ	1800M	TOW2	TRP-AB002 RJ
REMARKS <div style="text-align: center;">4 WRP - RJ AT 13629411, 100° AT 320M</div>					

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Figure H-8. Example of a completed range card.

- (1) **Position Identification.** List primary, alternate, or supplementary. Alternate and supplemental positions must be clearly identified.
- (2) **Date.** Show date and time the range card was completed.

Range cards are like fighting positions, constantly being updated. The date and time are vital in determining current data.

(3) **Weapon.** The weapon block indicates vehicle type and bumper number (C21, A11).

(4) **Each circle equals ____ meters.** Write in the distance, in meters, between circles.

(5) **NO (number).** Start with L and R limits, then list TRPs and RPs in numerical order.

NOTE: The platoon leader may designate a vehicle to shoot AP, HEI-T, or TOW at targets. This is dictated by platoon SOP or as needed by METT-TC.

(6) **Direction/Deflection.** The direction is in degrees and taken from a lensatic compass. The most accurate technique is to have the gunner aim at the terrain feature, and to have the driver dismount and align himself with the gun barrel and the terrain feature to measure the azimuth. To achieve correct deflection and elevation readings of the terrain feature, select TOW. Show the deflection reading taken from the BFV's azimuth indicator in the deflection block next to the magnetic azimuth.

(7) **Elevation.** Show the gun elevation reading in tens or hundreds of mils. The smallest increment of measure on the elevation scale is tens of mils. Any number other than "0" is preceded by a "plus" or "minus" symbol to show whether the gun needs to be elevated or depressed. Ammunition and range must be indexed to have an accurate elevation reading.

(8) **Range.** This is the distance, in meters, from vehicle position to L and R limits and TRPs and RPs.

(9) **Ammunition.** List types of ammunition used.

(10) **Description.** List the name of the object; for example, farmhouse, wood line, hilltop.

(11) **Remarks.** Enter the WRP data. As a minimum, WRP data include a description of what the WRP is, a six-digit or eight-digit grid coordinate of the WRP, the magnetic azimuth and the distance from the WRP to the vehicle position.

d. Complete the marginal information at the top of the card ([Figure H-8](#)).

(1) **Unit Description.** Bumper number, platoon, company, and so on. Never indicate a unit higher than company.

(2) **Magnetic North.** Orient the range card with the terrain and draw the direction of the magnetic north arrow.

Section II. SECTOR SKETCHES

Individual soldiers in squads and BFV gunners prepare range cards. Squad leaders prepare squad sector sketches and section leaders prepare section sector sketches. The platoon leader reviews his squads' and sections' sector sketches and ensures the sketches meet his intent. If he finds any gaps or other flaws, the platoon leader adjusts weapons locations or sectors. Once the platoon leader approves the squad and section sector sketches, he prepares a consolidated report for the company team commander and incorporates this into a consolidated platoon sector sketch. The platoon leader or platoon sergeant physically prepares the platoon sector sketch. The sector sketch can be on acetate taped to a map or it can be a hand drawn sketch. Accurate and detailed sketches aid in direct fire planning, and in direct fire control and distribution.

H-7. SQUAD AND SECTION SECTOR SKETCH

The squad leaders and section leaders make two copies of their sector sketches; one copy goes to the platoon leader, the other remains at the position. The squad leaders and section leaders draw sector sketches ([Figure H-9](#)) as close to scale as possible, showing:

- Main terrain features in the sector and the range to each.
- Each primary position.
- Engagement area or primary and secondary sectors of fire covering each position.
- M240B machine gun FPL or PDF (if applicable)
- M249 squad automatic weapon FPLs or PDFs
- Type of weapon in each position.
- Reference points and Ttarget reference points in the sector.
- Observation post locations.
- Dead space.
- Obstacles.
- MELs for all BFV weapon systems.
- MELs for Javelin (if applicable) and AT4s.

□ Indirect fire targets.

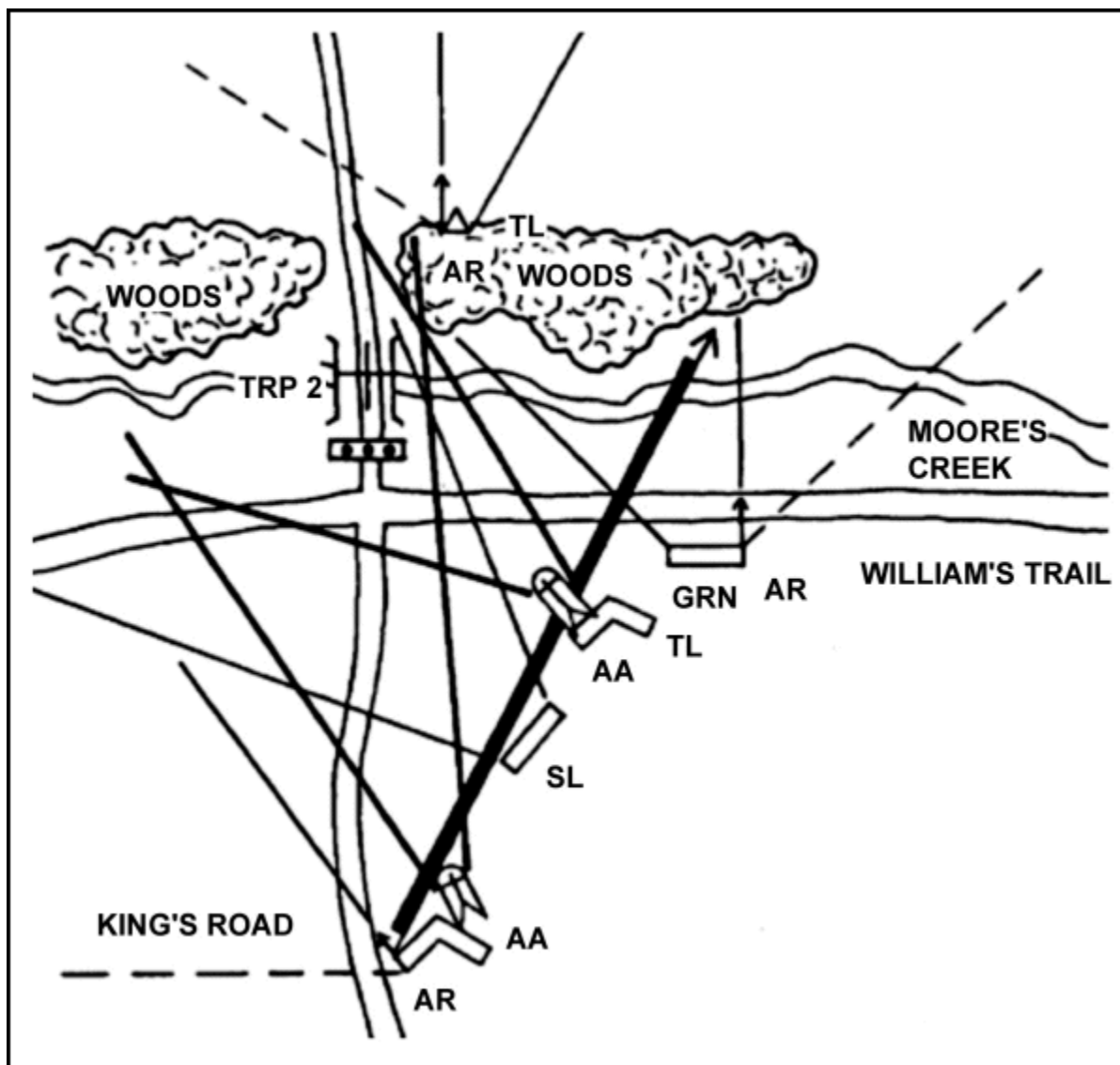


Figure H-9. Squad sector sketch

H-8. PLATOON SECTOR SKETCH

Squad leaders and section leaders prepare their sketches and submit them to the platoon leader. The platoon leader combines all sector sketches (and possibly separate range cards) to prepare a platoon sector sketch. A platoon sector sketch ([Figure H-10](#)) is drawn as close to scale as possible and includes a target list for direct and indirect fires. One copy is submitted to the company team commander, one copy is given to the platoon sergeant (controlling the mounted element), and one copy is given to the leader of the dismounted element (usually, the platoon leader). As a minimum, the platoon sector sketch should show:

- Primary and secondary sectors of fire or engagement areas.
- Primary, alternate, and supplementary BFV and squad positions.
- Remount points.
- Javelin, M240B, and M249 positions with primary directions of fire.
- M240B and M249 FPLs or PDFs
- MELs for 25-mm, M240C, and TOW.
- Observations posts.
- Target reference points.
- Mines and other obstacles.
- Indirect fire target locations and FPF location (if applicable).
- Position and sector of flanking unit vehicles.
- Priority engagement by weapon system and crew.

NOTE: FBCB2 in M2A3-equipped units provides leaders a more accurate means for recording and sharing sector sketch and range card data. If the platoon leader finds any gaps or other flaws, the platoon leader adjusts weapons locations or sectors. Once the platoon leader approves the squad sector sketches and vehicle range cards, he prepares a consolidated report and incorporates this into a consolidated platoon sector sketch. These locations are forwarded to company (then to battalion) using FBCB2 to plot the requisite no-fire areas and graphic fire control measures.

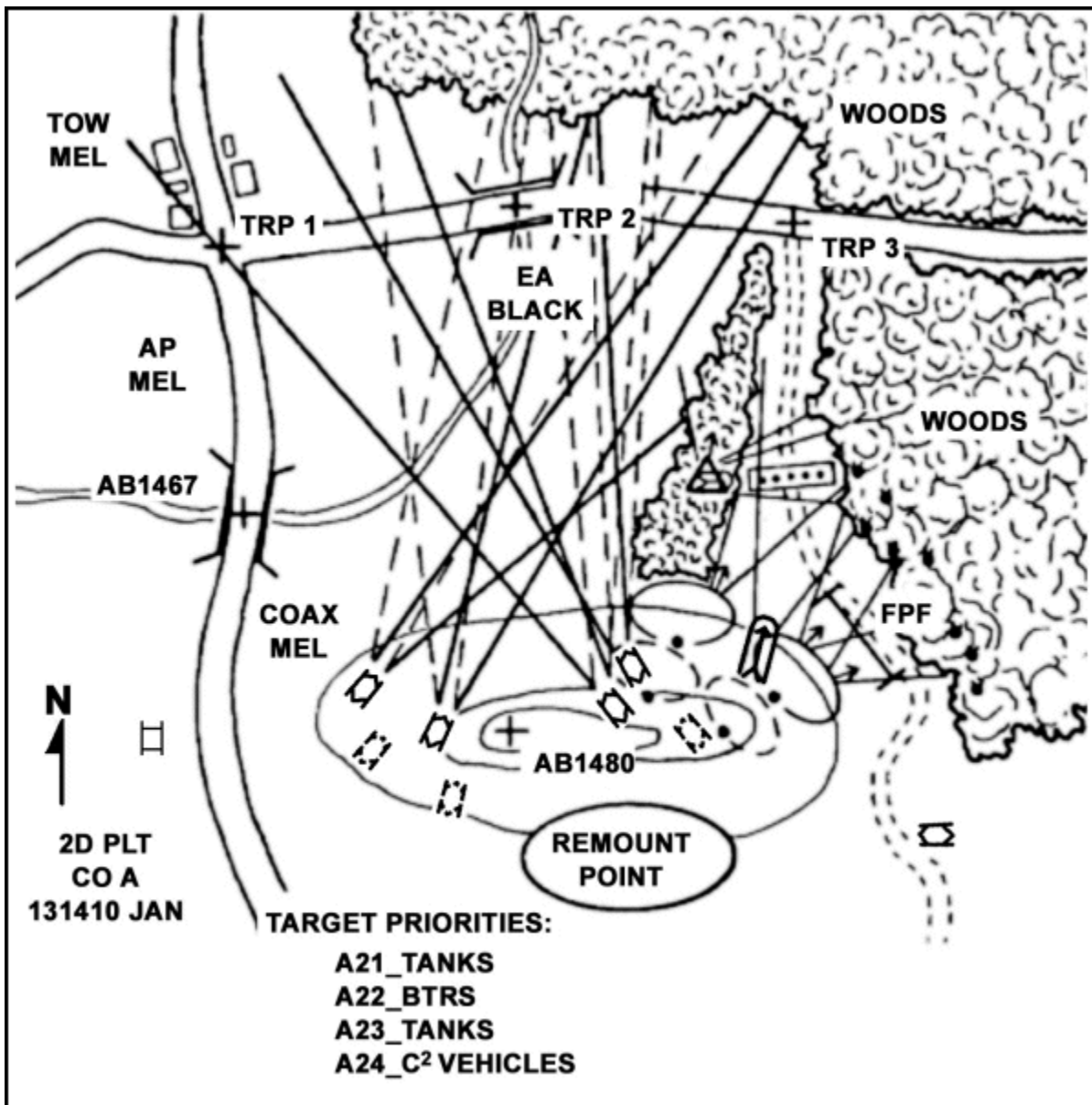


Figure H-10. Platoon sector sketch.

H-9. COORDINATION WITH ADJACENT UNITS

Platoon leaders coordinate with adjacent platoons. Squad leaders coordinate with adjacent squads so that all positions and all platoon and squads are mutually supporting. The platoon leader must ensure that this coordination take place. Coordination is usually initiated from left to right. Gaps between positions are covered by fire as a minimum. Contact points are established to ensure friendly forces meet at some specific point on the ground to tie in their flanks. In many cases, the exchange of sector sketches will accomplish most of this. Typical information that is exchanged includes:

- Locations of primary, alternate, and supplementary positions;

sectors of fire for BFVs, M240Bs and Javelins.

- Location of dead space between platoons and how it is to be covered.
- Location of Observation posts.
- Location and types of obstacles and how to cover them.
- Patrols (size, type, time of departure and return, and routes).

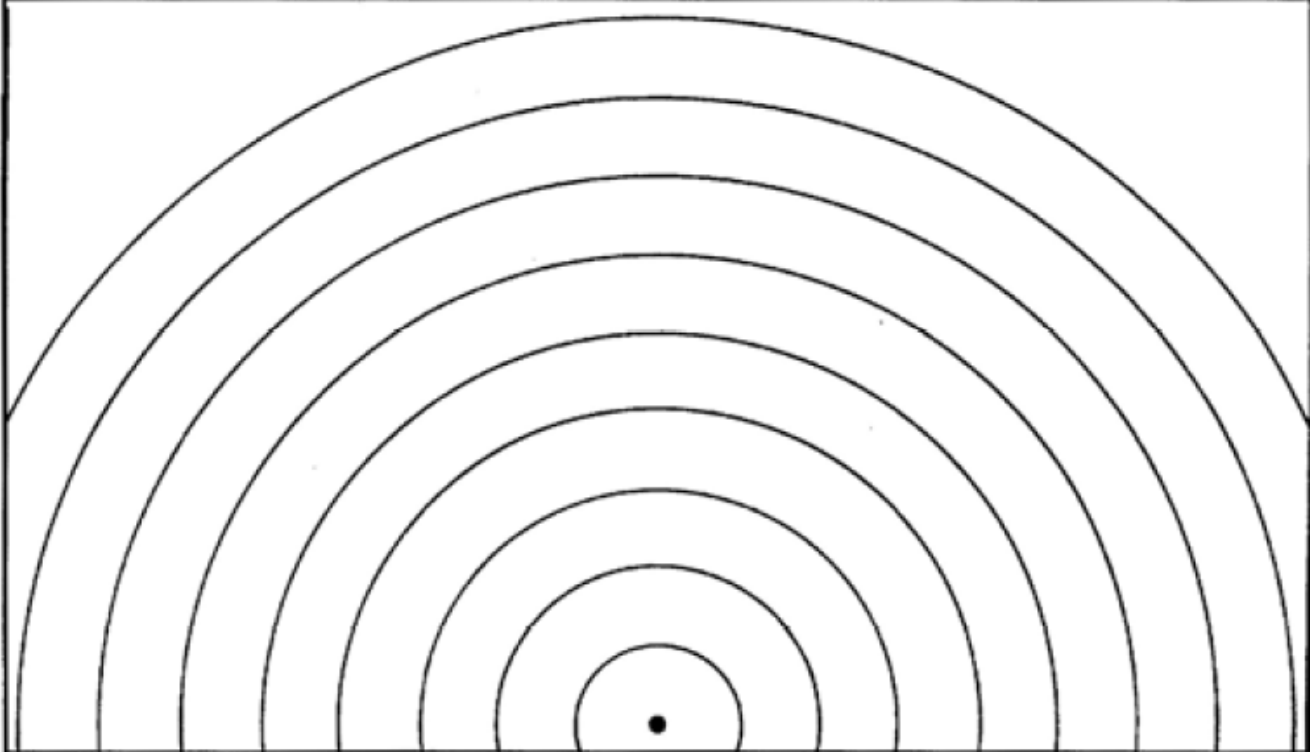
STANDARD RANGE CARD

For use of this form see FM 3-21.71; the proponent agency is TRADOC.

SQD _____
PLT _____
CO _____

May be used for all types of direct fire weapons.

MAGNETIC
NORTH



DATA SECTION

POSITION IDENTIFICATION

DATE

WEAPON

EACH CIRCLE EQUALS
METERS

NO.	DIRECTION/ DEFLECTION	ELEVATION	RANGE	AMMO	DESCRIPTION

REMARKS: